

Association between periodontal diseases and systemic diseases

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Abstract: Current evidence suggests that periodontal disease may be associated with systemic diseases. This paper reviewed the published data about the relationship between periodontal disease and cardiovascular diseases, adverse pregnancy outcomes, diabetes and respiratory diseases, focusing on studies conducted in the Brazilian population. Only a few studies were found in the literature focusing on Brazilians (3 concerning cardiovascular disease, 7 about pregnancy outcomes, 9 about diabetes and one regarding pneumonia). Although the majority of them observed an association between periodontitis and systemic conditions, a causal relationship still needs to be demonstrated. Further studies, particularly interventional well-designed investigations, with larger sample sizes, need to be conducted in Brazilian populations.

Descriptors: Periodontitis; Cardiovascular diseases; Pregnancy complications; Diabetes *mellitus*; Lung diseases.

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Introduction

The understanding of the etiology and pathogenesis of periodontal diseases and their chronic, inflammatory and infectious nature¹ necessitates admitting the possibility that these infections may influence events elsewhere in the body. At the same time, recognition of the interaction between oral diseases and some systemic conditions entails that dentists and periodontists should direct their practice and knowledge not only to events strictly related to the oral cavity but also consider systemic conditions and diseases which may change or interfere with established preventive and therapeutic approaches.

The concept that oral diseases could influence distant structures is, to a certain extent, a return to the theory of focal infection. The evidence supporting this theory dates from around 1900 and it was based on the expert opinion and personal clinical experience of a few physicians and dentists. Some reports of questionable scientific merit have also supported the influence of dental sepsis on systemic health.² The return of this concept since the end of the 80's has been investigated in a quite different scenario. Advances in the methods of scientific investigation were undoubtedly decisive in this context. The development of epidemiological studies and statistical analysis, the enhanced understanding of biological plausibility by means of advances in molecular biology, microbiology, immunology and genetics, the possibility of successfully treating periodontal diseases, caries and endodontic infections and retaining teeth instead of extracting them, all these factors have led dental and medical researchers and clinicians to resume the study of the relationship between oral diseases and systemic conditions with a more scientific approach.

This paper discusses the relationship between periodontal diseases and the most studied systemic conditions: cardiovascular diseases, adverse pregnancy outcomes, diabetes *mellitus* and respiratory diseases. Each section presents the current state of

the field, indicates questions to be answered and presents studies performed in Brazilian populations.

Periodontal diseases and cardiovascular diseases

Cardiovascular diseases (CVD) are a group of diseases that include congestive heart failure, cardiac arrhythmias, coronary artery disease (including atherosclerosis and myocardial infarction), valvular heart disease and stroke. Among these, atherosclerosis, a major component of cardiovascular diseases, is characterized by the deposition of atherosclerotic plaques on the innermost layer of walls of large- and medium-sized arteries. End-stage outcomes associated with atherosclerosis include coronary thrombosis, myocardial infarction and stroke.

CVD and periodontitis are both chronic and multifactorial diseases, and share some of their risk factors: age, male gender, lower socioeconomic status, smoking and psychosocial factors such as stress.³ Recently, periodontal disease (PD) has been investigated as a potential factor contributing to the onset and development of CVD.

Several mechanisms that could explain this association have been investigated. The host response to the presence of periodontal pathogens may trigger the production of inflammatory mediators such as C-reactive protein, TNF- α , PGE₂, IL-1 β and IL-6, which can accelerate the progression of pre-existing atherosclerotic plaques⁴ and are related to an increased number of adverse cardiovascular events.⁵ Also, several studies demonstrated the ability of periodontal pathogens to induce platelet aggregation and the formation of atheromas.^{6,7}

A systematic review published in 2003⁸ studied the evidence supporting the association between PD and CVD. Thirty-one human studies were selected. The authors concluded that "periodontal disease may be modestly associated with atherosclerosis, myocardial infarction and cardiovascular events". Other three systematic reviews⁹⁻¹¹ reported a modest but significant association between CVD and periodontal disease.

Another question is whether periodontal treatment can decrease the risk for adverse cardiovascu-

lar events. However, so far there is limited evidence regarding this question. Cardiovascular events may take several years to occur, so the possible benefits of periodontal therapy are difficult to observe in interventional studies. Some investigations reported the effects of periodontal treatment on surrogate endpoints, such as C-reactive protein, which is associated with CVD.¹² However, a recent systematic review concluded that, up to now, there is no evidence that periodontal treatment can significantly reduce C-reactive protein levels.¹³

Few studies regarding this association have been conducted in the Brazilian population. One case-control study and two cross-sectional studies were retrieved from the Medline and Scielo databases, using the words “periodontitis”, “periodontal”, “cardiovascular”, “infarction” and “atherosclerosis” (Table 1).

The case control study, conducted in Southern Brazil, found a significant association between periodontitis and acute coronary syndrome.¹⁶ One cross-sectional study¹⁴ observed significant association between periodontal disease and severe obstruction of coronary artery. However, the authors did not present multivariate analysis with adjustment for confounders related to periodontitis and CVD. The other cross-sectional study¹⁵ did not present a multivariate analysis to investigate the association between the two conditions, and reported that periodontal disease was elevated in patients

with Ischemic Coronary Atherosclerosis. Some potential methodological biases should be considered in order to avoid erroneous conclusions about a causal relationship between periodontal disease and adverse cardiovascular events in these populations. The criteria adopted to define periodontal disease exposure in these studies must also be carefully analyzed. More interventional studies, with larger sample sizes, need to be conducted in the Brazilian population.

Adverse pregnancy outcomes and periodontal diseases

This section will focus particularly on the relationship between periodontal diseases and preterm birth and low birth weight, which has been extensively studied in last years all over the world.

The first study to report the influence of poor oral health on the birth of low weight and preterm infants was performed by Offenbacher and colleagues.¹⁷ They obtained obstetric and demographic information from the studied patients’ prenatal records and performed full mouth periodontal examinations in 93 mothers who gave birth to preterm or low weight infants and compared them to those of 31 mothers who had term deliveries and normal weight infants. Multivariate analysis showed that the women with more than 60% of sites with clinical attachment loss of 3 mm or more were seven

Table 1 - Studies assessing the relationship between periodontal disease and cardiovascular diseases in Brazilian populations.

Authors	Study design	Population	Periodontal outcome or exposure	Cardiovascular disease outcome	Findings and conclusions
Accarini, de Godoy ¹⁴ (2006)	Cross-Sectional	361 patients from a Hospital in São Paulo (SP)	30% of sites with clinical attachment level and/or periodontal pocket depth \geq 5 mm	Severe obstruction of coronary artery (at least one obstruction \geq 50%)	Significant association between periodontal disease and severe obstruction of coronary artery (OR 2.571, CI 1.192-5.547)
Barilli <i>et al.</i> ¹⁵ (2006)	Cross-Sectional	634 patients from a Hospital in Ribeirão Preto (SP)	Presence of periodontal disease according to Community Periodontal Index	Ischemic Coronary Atherosclerosis	Periodontal disease was elevated in patients with Ischemic Coronary Atherosclerosis
Rech <i>et al.</i> ¹⁶ (2007)	Case-control	58 cases (acute coronary syndrome) and 57 matched controls from a hospital in Gravataí (RS)	Presence of periodontal pockets, attachment loss and gingival inflammation	Presence of acute coronary syndrome	Significant association between periodontitis and acute coronary syndrome (OR 5.1 CI 1.7-14.8)

times more likely to have an adverse pregnancy outcome than periodontally healthy women (OR = 7.5; CI 1.98-28.8).

The etiology of preterm birth is multifactorial, but inflammation is the common pathway that leads to uterine contractions and cervical changes with or without premature rupture of membranes. Inflammation associated to preterm birth can be mainly attributable to intrauterine infection and bacterial vaginosis, and the latter accounts for up to 40% of the cases of spontaneous preterm labor and preterm birth. There is also a causal relationship between bacterial vaginosis and preterm birth¹⁸ and the presence of significantly higher levels of proinflammatory cytokines and prostaglandins in the amniotic fluid. This is a common finding in women with bacterial vaginosis who deliver preterm.^{19,20} At the same time, an infection remote to the genital tract can also trigger preterm birth, and this is the case for pregnant women with periodontal disease.

Biological plausibility of the link between both conditions, periodontal disease and preterm birth, does exist and can be summarized in three potential pathways.^{20,21} One of them refers to the hematogenous dissemination of inflammatory products from a periodontal infection, while the second potential pathway involves the fetomaternal immune response to oral pathogens. The third pathway proposed to explain the theoretical causal relationship between periodontal disease and preterm birth involves bacteremia from an oral infection.

Since 1994, several studies have been conducted concerning the relation between periodontal diseases and preterm birth and diverse findings have been reported all over the world. There appears to be an association between both conditions, but whether periodontitis is a confounding factor, a marker or one of the causes of preterm birth remains unclear.²² The reader is referred to additional studies in order to get acquainted with the larger body of literature on this theme.^{23,24}

It is important to point out that, in spite of the high number of studies published, only a few of them are randomized clinical trials, which represents the research design that generates the weightiest evidence when assessing claims of causation. In this context,

two clinical trials should be mentioned. The first one was performed by Lopez *et al.*²⁵ (2002) in Chile with 163 pregnant women who received periodontal treatment during pregnancy and 188 women who received the same treatment after delivery. Preterm/low birth weight rate was 1.8% for the test group and 10.1% for the control group. The authors demonstrated that the presence of periodontitis was significantly associated with preterm/low birth weight in the population studied (OR 4.7, CI 1.29-17.13). The other randomized clinical trial was performed in the United States²⁶ with 413 pregnant women who received monthly oral health instruction and scaling as needed and 410 pregnant women who were submitted to brief monthly oral exams during pregnancy. Preterm birth occurred in 12% and 12.8% of the patients from the test and control groups, respectively. Periodontal treatment significantly improved all periodontal parameters but it did not improve preterm delivery (OR 0.93, CI 0.63-1.37).

Conflicting findings have been found not only in these two clinical trials but also in the literature published since 1994 in this area. Several criteria, such as the definition of periodontal disease, experimental design, compliance with treatment and the time of periodontal treatment delivered in clinical trials, controlling for confounding variables and outcome definition are pointed out in order to understand the diversity of the results presented. Another issue addressed in this discussion is the fact that different populations may not share the same risk factors to both conditions, periodontal diseases and adverse pregnancy outcomes. It will thus be necessary to conduct studies taking into account socioeconomic, biologic and environmental determinants for each population.

Specifically in the Brazilian population, some studies were performed and are detailed in Table 2. Five case control studies and two cross sectional studies were retrieved from Medline with the words “periodontitis”, “preterm birth”, “low birth weight” and “Brazil”. Two other studies were not included because of inadequate outcome measure²⁷ and partial data reporting.²⁸

One cross sectional study performed in the state of Santa Catarina found no association between

Table 2 - Studies assessing the relationship between periodontal disease and adverse pregnancy outcomes in Brazilian populations.

Authors	Study design	Population	Periodontal outcome or exposure	Adverse pregnancy outcome	Variables included in the final model	Findings and conclusions
Cruz et al. ²⁹ (2005)	Case-control	102 cases and 200 controls from a public hospital in Feira de Santana (BA)	≥ 4 sites with clinical attachment levels ≥ 4 mm	Low birth weight (< 2,500 g)	No adjustment for classic confounding variables	Significant association between low birth weight and periodontitis for mothers with low educational level (OR 3.98, CI 1.58-10.10)
Lunardelli, Peres ³⁰ (2005)	Cross-sectional	449 women from a maternity hospital in Itajaí (SC)	≥ 1 site with probing depth ≥ 3.5 mm ≥ 4 sites with probing depth ≥ 3.5 mm	<ul style="list-style-type: none"> • Preterm birth (< 37 weeks) • Low birth weight (< 2,500 g) • Preterm and low birth weight 	Periodontal disease, schooling, parity, previous low birth weight, body mass index, number of prenatal visits, genitourinary infection, hypertension, dental treatment and oral health guidance	No significant association between periodontal disease and prematurity when maternal health variables were included (OR 2.7, CI 0.7-9.7)
Moliterno et al. ³¹ (2005)	Case-control	76 cases and 75 controls from a public maternity hospital in Rio de Janeiro (RJ)	≥ 4 sites with probing depth ≥ 4 mm and clinical attachment level ≥ 3 mm	Preterm birth (< 37 weeks) and low birth weight (< 2,500 g)	Periodontitis, genitourinary infection, race, prenatal location, arterial hypertension, vaginal bleeding, alcohol use, smoking, number of prenatal visits, diabetes and educational level	Significant association between low birth weight and periodontitis (OR 3.48, CI 1.17-10.36)
Bassani et al. ³² (2007)	Case-control	304 incident cases and 611 controls from three hospitals in Porto Alegre (RS)	≥ 3 sites with clinical attachment level ≥ 3 mm	Low birth weight (< 2,500 g) at > 27 weeks of gestational age	Maternal age, parity, prenatal care, smoking, previous preterm or low birth weight, hypertension, pre eclampsia and weight change during pregnancy	No association between periodontitis and low birth weight (OR 0.93, CI 0.63-1.41)
Siqueira et al. ³³ (2007)	Case-control	263 cases and 1,042 controls from a public hospital in Belo Horizonte (MG)	≥ 4 sites with probing depth ≥ 4 mm and clinical attachment level ≥ 3 mm	Preterm birth (< 37 weeks), low birth weight (< 2,500 g) and intrauterine growth restriction	Educational level, maternal age, prenatal visits, chronic hypertension, primiparity, previous abortion, previous preterm birth and maternal periodontitis	<ul style="list-style-type: none"> • Significant association between preterm birth and periodontitis (OR 1.77, CI 1.12-2.59) • Significant association between low birth weight and periodontitis (OR 1.67, CI 1.11-2.51) • Significant association between preterm birth and intrauterine growth restriction (OR 2.06, CI 1.00-4.19)
Santos Pereira et al. ³⁴ (2007)	Cross-sectional	68 women with preterm labour and 56 women with term labour from a university hospital in Campinas (SP)	≥ 1 site with clinical attachment level ≥ 1 mm and bleeding on probing	Preterm labour (gestational age < 37 weeks, admitted in the hospital for intravenous tocolysis)	Age, ethnicity, parity, schooling, marital status and number of prenatal visits	<ul style="list-style-type: none"> • Significant association between preterm birth and periodontitis (OR 4.9, CI 1.9-12.8) • Significant association between low birth weight and periodontitis (OR 4.2, CI 1.3-13.3)
Siqueira et al. ³⁵ (2008)	Case-control	125 cases and 375 matched controls from a public hospital in Belo Horizonte (MG)	≥ 4 sites with probing depth ≥ 4 mm and clinical attachment level ≥ 3 mm	<ul style="list-style-type: none"> • Pre eclampsia • Blood pressure > 140/90 mm Hg on two occasions after 20 weeks of gestation and ≥ 1+ urine dipstick value 	Maternal age, primiparity, chronic hypertension, number of prenatal visits, previous preterm birth and maternal periodontitis	<ul style="list-style-type: none"> • Significant association between pre eclampsia and preterm birth (OR 3.15, CI 1.04-9.52) • Significant association between pre eclampsia and maternal periodontitis (OR 1.52, CI 1.01-2.29)

periodontitis and preterm birth when a high number of variables were included in the analysis.³⁰ Another cross sectional study performed in the state of São Paulo showed that periodontitis may be a risk indicator for women with a diagnosis of preterm labor.³⁴

Four case control studies investigated the relationship between periodontitis and low birth weight. Three of them found a significant association between both conditions^{29,31,33} and the fourth failed to demonstrate an association between periodontitis and the birth of infants with less than 2,500 g.³² It is important to mention that in one of the studies there were no adjustment for classic confounding variables related to periodontitis and low birth weight.²⁹ Studies performed in the city of Belo Horizonte also evaluated the association of periodontitis with preterm birth, intrauterine growth restriction and preeclampsia and the authors showed significant association with all the adverse pregnancy outcomes investigated.^{33,35}

Similarly to the investigations in other populations, studies in the Brazilian population may indicate an association between periodontitis and adverse pregnancy outcomes. However, potential methodological biases should be thoroughly analyzed in order to avoid erroneous and premature conclusions. Moreover, the limited number of randomized clinical trials published up to now in the international literature and the absence of studies with this design in the Brazilian population prevents us from offering a definitive conclusion.

Periodontal disease and diabetes mellitus

Diabetes is a group of metabolic diseases characterized by hyperglycemia and results from either a deficiency in the secretion of insulin and/or reduced insulin action.³⁶ In type 1 diabetes, there is an absolute deficiency of insulin. In type 2 diabetes, there is the involvement of resistance to insulin and an inability of the pancreas to compensate for this resistance. Severe hyperglycemia can cause numerous symptoms, including polyuria, polyphagia, polydipsia, weight loss and blurred vision.³⁷ There is peripheral vascular insufficiency, causing scarifying disorders and physiological changes that reduce

the immunological capacity, thereby increasing the susceptibility to infection. A greater glucose and calcium content in the saliva favors an increase in the amount of calculus and irritating factors to oral tissues, leading to periodontal disease, which is the most common dental manifestation in the oral cavity among diabetic patients (75%).³⁸

Chronic periodontal disease and diabetes *mellitus* are common chronic conditions in adults throughout the world.³⁹ Severe periodontal disease often coexists with diabetes and is considered the sixth most common complication of the disease.⁴⁰ A number of studies have demonstrated that poor blood sugar control may contribute to poor periodontal health⁴¹⁻⁴⁷ and that such individuals have a 2.8-fold greater chance of developing destructive periodontal disease⁴² as well as a 4.2-fold greater chance of having progressive alveolar bone loss.⁴⁸ The increased risk of developing periodontal disease cannot be explained by age, gender or hygiene.⁴⁹ The interrelationship between periodontal disease and diabetes provides an example of a systemic disease predisposing individuals to oral infection and, once the infection is installed, it exacerbates the systemic disease.³⁹

The interrelationship between diabetes and periodontal disease is established through a number of pathways⁵⁰ and is bidirectional.⁵¹ Diabetes is a risk factor for gingivitis and periodontitis.^{52,53} Blood sugar control is an important variable in the relationship between diabetes and periodontal disease. Individuals who have poor control over glycemia have a greater prevalence and severity of gingival and periodontal inflammation.⁵⁴⁻⁵⁶ It has been suggested that hyperglycemia promotes periodontitis and its progression.^{51,57-62}

One of the mechanisms to explain the relationship between diabetes *mellitus* and periodontal disease suggests that the presence of periodontal disease may induce or perpetuate a state of chronic systemic inflammation, as demonstrated by the increase in the C-reactive protein, interleukin-6 (IL-6) and fibrinogen levels found in individuals with periodontitis.⁶³ Periodontal infection may elevate the state of systemic inflammation and exacerbate the resistance to insulin, as the inflammatory pro-

cess induces this resistance. Furthermore, it may induce increased levels of IL-6 and TNF- α , which is similar to obesity inducing or exacerbating the resistance to insulin.⁶⁴

The synergism between diabetes and periodontal disease has been demonstrated in a number of studies. It has been made clear that effective periodontal treatment can improve some complications of diabetes, especially hyperglycemia, and that severe periodontitis is associated to poor blood sugar control. Periodontal treatment improves blood sugar control, especially in individuals with type 2 diabetes, and its association to low glycosylated hemoglobin levels has been demonstrated.⁶⁰

A number of studies have found that non-surgical periodontal treatment improves the metabolic control of diabetic patients, thereby influencing a reduction in glycosylated and glycemic hemoglobin levels.⁶⁵ Patients with diabetes have a good response to periodontal treatment, whether in the short or long term, and this response is similar to that observed

in non-diabetic patients. However, if the diabetes is not well controlled, the recurrence of periodontal disease is more frequent and more difficult to control. The influence of diabetes over periodontal disease is well established, but the effect of periodontitis and its treatment over the control of diabetes remains unclear.⁶⁶

In Brazil, few studies have been carried out assessing the relationship between diabetes and periodontal disease. There are also few studies addressing the benefits of periodontal treatment regarding blood sugar control. Table 3 presents the studies carried out in the Brazilian population. These studies were retrieved from the Medline, Scielo and Lilacs databases, using the words “periodontitis”, “Brazil”, “Brazilian” and “diabetes”.

In 2003, Rodrigues *et al.*⁴⁹ assessed 30 individuals with type 2 diabetes *mellitus* and periodontitis. The authors divided the patients into two groups – one group underwent mechanical periodontal treatment and the other group underwent that treatment

Table 3 - Studies assessing the relationship between periodontal disease and diabetes *mellitus* in Brazilian populations.

Authors	Population	Diabetes	Findings and conclusions
Novaes Jr <i>et al.</i> ⁶⁷ (1991)	30 diabetics / 30 controls aged 5 to 18 years	Type 1	Greater mean indices of plaque, gingivitis and alveolar bone loss among diabetics when compared to healthy controls.
Novaes Jr <i>et al.</i> ⁴⁴ (1996)	30 diabetics / 30 controls aged 30 to 77 years	Type 2	A one-year follow up found no difference in probing depth, but there was a significant difference in insertion loss between diabetics and controls.
Novaes Jr <i>et al.</i> ⁶⁸ (1997)	11 diabetics	Type 1	Although the patients did not receive periodontal treatment over a 10-year period, there was a slight increase in plaque, gingivitis, probing depth and bone loss.
Novaes Jr <i>et al.</i> ⁶⁹ (1997)	30 diabetics / 30 controls aged 30 to 77 years	Type 2	Using the BANA test, there was no significant difference between diabetics and controls.
Rodrigues <i>et al.</i> ⁴⁹ (2003)	30 diabetics	Type 2	Patients were divided into 2 groups – one received conventional therapy and the other received therapy + doxycycline. There was a 10% reduction in glycosylated hemoglobin level, with statistical significance for the group that only received mechanical treatment.
Martorelli de Lima <i>et al.</i> ⁷⁰ (2004)	11 diabetics aged 35-55 years	Type 1	Patients had pockets with depths \geq 5 mm treated with conventional therapy and sub-gingival administration of doxycycline gel or conventional therapy + placebo. Better results were obtained in the group that used doxycycline.
Souza <i>et al.</i> ⁷¹ (2006)	44 diabetics / 19 controls	Type 2	No difference in blood sugar control was found, not even following non-surgical periodontal therapy associated or not to systemic doxycycline.
Drumond-Santana <i>et al.</i> ⁷² (2007)	159 diabetics	Type 1 Type 2	Using the OHIP-14 index, the impact of periodontal disease on the quality of life of diabetic individuals was assessed. It was concluded that diabetics with periodontitis suffered a greater negative impact on quality of life than periodontally healthy diabetics or those with gingivitis.
O'Connell <i>et al.</i> ⁷³ (2008)	30 diabetics	Type 2	No additional effect from doxycycline associated to conventional mechanical therapy was found.

associated to the use of amoxicillin and clavulanic acid. Glycated hemoglobin levels, glycemia and clinical periodontal parameters were assessed at baseline and three months following therapy. The authors concluded that non-surgical periodontal therapy improved blood sugar control in both groups and the reduction of glycated hemoglobin was only statistically significant in the group that did not make use of antibiotics.

To assess the effect of the sub-gingival administration of doxycycline as an auxiliary aid in periodontal treatment among patients with type 1 diabetes, Martorelli de Lima *et al.*⁷⁰ (2004) treated 11 individuals, who were required to present two sites with probing depths ≥ 5 mm and bleeding or suppuration upon probing. For one group, the treatment consisted of scaling and root planing therapy associated to the sub-gingival administration of a 10% doxycycline hyclate gel, whereas the other group received scaling and root planing associated to a placebo gel. The authors concluded that the use of doxycycline produced additional favorable effects over the scaling and root planing alone.

Souza *et al.*⁷⁴ (2006) studied the effect of periodontal therapy on glycated hemoglobin levels in 63 non-insulin-dependent diabetic adults, who were divided into four groups: Group 1 – healthy controls; Group 2 – diabetics with no periodontal disease; Group 3 – diabetics with periodontitis submitted to periodontal therapy; and Group 4 – diabetics with periodontitis submitted to periodontal therapy associated to the administration of systemic doxycycline. The authors found no statistically significant difference in blood sugar control following periodontal therapy with or without the use of systemic antibiotics.

In a double-blind, placebo-controlled study assessing the effect of periodontal therapy (scaling and root planing) on glycated hemoglobin levels and biomarkers, O'Connell *et al.*⁷³ (2008) treated 30 patients with type 2 diabetes. One group was treated with doxycycline and mechanical therapy and the other group was treated with mechanical therapy alone. The authors concluded that there was an improvement in blood sugar control, but there was no significant difference between the use and non-use

of doxycycline.

Current evidence is insufficient to determine whether periodontal treatment, whether associated to antibiotic therapy or not, is effective in controlling glycated hemoglobin and blood sugar levels in patients with diabetes.

Periodontal diseases and respiratory diseases

Respiratory diseases is the term for diseases of the respiratory system, including lung, pleural cavity, bronchial tubes, trachea, and upper respiratory tract. They range from a common cold to life-threatening conditions such as bacterial pneumonia or chronic obstructive pulmonary disease (COPD), which are important causes of death worldwide.

COPD is a pathological and chronic obstruction of airflow through the airways or out of the lungs, and includes chronic bronchitis and emphysema. Its main risk factor is smoking, but air pollution and genetic factors are also strongly implicated.

Pneumonia (both community-acquired and hospital acquired) is an acute infection of the lung and is characterized by cough, breath shortness, sputum production and chest pain. It is caused by the micro-aspiration of oropharyngeal secretions containing bacteria into the lung, and failure of the host to clear the bacteria.

There is increasing evidence that a poor oral health can predispose to respiratory diseases, especially in high-risk patients (nursing home residents, older subjects, intensive care unit patients and hospitalized individuals requiring mechanical ventilation). The oral cavity is contiguous with the trachea and may be a portal for respiratory pathogen colonization. Dental plaque can be colonized by respiratory pathogens,⁷⁵ which may be aspirated from the oropharynx into the upper airway and then reach the lower airway and adhere to bronchial or alveolar epithelium.⁷⁶

A recent systematic review investigated if there was an association between oral health and pneumonia or other respiratory disease.⁷⁷ The authors reviewed 19 studies that met the inclusion criteria and concluded that there is fair evidence of an association of pneumonia with oral health, but there is

poor evidence of a weak association between COPD and oral health. The authors also concluded that improved oral hygiene and professional oral health care reduces the progression or occurrence of respiratory diseases among high-risk elderly adults. A recent prospective study⁷⁸ conducted with 697 elderly individuals observed that the adjusted mortality due to pneumonia was 3.9 times higher in subjects with periodontal disease.

As discussed above, the oral cavity serves as a reservoir for respiratory pathogens. So, oral hygiene interventions may reduce colonization by these pathogens and, consequently, decrease the risk for pneumonia, especially in high-risk populations. Scannapieco *et al.*⁷⁹ (2003) conducted a systematic review about the effectiveness of oral decontamination to prevent pneumonia. A meta-analysis on 5 intervention studies revealed that oral interventions improving oral hygiene through mechanical and/or chemical disinfection reduced the incidence of nosocomial pneumonia by an average of 40%. A recent multicenter trial assessed the efficacy of a 0.2% chlorhexidine gel in the reduction of the rate of pneumonia in 228 non-edentulous patients requiring endotracheal intubation and mechanical ventilation.⁸⁰ Although the intervention significantly decreased

the oropharyngeal colonization by aerobic pathogens, no significant reduction in the incidence of respiratory infections was observed.

There is a lack of information about the association between oral health and respiratory diseases in Brazilian populations. One investigation conducted in Brazil was retrieved using the words “periodontitis”, “oral health”, “dental”, “pneumonia” and “respiratory” in the Medline and Scielo databases. In this cross-sectional study,⁸¹ 30 hospital patients with diagnosis of nosocomial pneumonia were included. Samples from tracheal aspirate, supragingival dental plaque and tongue were analyzed. Seventy percent of the bacteria isolated from the tracheal aspirate were also found in the dental biofilm. The authors concluded that dental biofilm could act as a reservoir for respiratory pathogens.

Conclusion

Most of the reviewed studies focusing on the Brazilian population demonstrated an association between periodontal disease and systemic conditions. However, more studies are needed, particularly interventional investigations, in order to establish a causal relationship between the two conditions.

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